STANDARD OPERATING PROCEDURE
Obtaining and Preserving Well Water Samples

KEY WORDS

Permission, purging, preservation, storage, ground water, sampling

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1.0 INTRODUCTION

1.1 Purpose

This SOP provides instructions for obtaining permission, purging and collecting a water sample from a well, and then how to preserve the sample. With a two-person crew, staff may divide the tasks by one person conducting sampling (3.3) and the other conducting the documentation (3.11).

1.2 Definitions

1.2.1 **Purging-**eliminates standing water from a well and allows the system to be recharged with fresh water from the aquifer.

2.0 MATERIALS

2.1 A copy of this and other appropriate SOP's and the study protocol

2.2 Important phone numbers (your supervisor, EM branch managers, DPR Business Services Office (BSO), Branch Chief, and "2nd in command")

2.3 DPR permission form to sample well

2.4 Plastic bag (18 in by 24 in) for ground cover

2.5 Plastic bag (6 in by 12 in) to cover electrical points

2.6 Replacement (Schrader®) snifter valves

2.7 Replacement snifter valve core stems

2.8 Alligator valve caps (Gator®)

2.9 Snifter valve core stem remover

2.10 Snifter valve sampling tube

2.11 Locking pliers to secure Teflon® tube to snifter valve while sampling if unable to use the alligator valve caps

2.12 5/16 and 7/16 box end wrenches for replacing snifter valve if needed

2.13 Teflon® tape

2.14 Sample containers (refer to SOP QAQC005.00)

2.15 De-ionized or distilled water (DI water in this SOP can represent either)

2.16 Polystyrene foam holders for one-liter sample bottles (6-packs) or appropriate packing for other size containers

2.17 1 half-pint mason jar

2.18 pH meter or pH litmus paper

2.19 Preservative, if necessary (refer to section 4.4)

2.20 Ice chests

2.21 Ice materials (refer to “Study Specific Decision Section”)

2.22 Chain of Custody form

2.23 DWR form 429

2.24 Well information form

2.25 Digital camera

2.26 GPS unit

2.27 Water level meter

2.28 Measuring wheel

2.29 Rangefinder

2.30 Extra sample bottles

2.31 Latex gloves (size(s) appropriate for sampling crew)

2.32 Duct tape and/or rubber bands to secure plastic bag around points box

2.33 Tool box which has check list for above items attached

2.34 Garden hose

2.35 Bucket

3.0 PROCEDURES

3.1 Obtain Permission to Sample Well

You must obtain the well owner’s permission to collect samples before beginning any part of the sampling procedure, including evaluating the suitability of the well.

3.1.1 Introduce yourself and explain the project. Determine the relationship of the person at the sampling location to the well (well owner, a tenant, etc).

3.1.2 If the occupant is the owner, review the Well Sampling Permission Form with them, complete the form and ask them to sign it indicating permission for sampling to begin (Appendix 1).

3.1.3 If the occupant is not the well owner, obtain contact information for the well owner. Use this information to contact the well owner and gain permission to sample the well.

3.1.4 If the owner is unavailable to sign, or declines to sign the form, but grants permission to sample the well, record the name, mode in which the permission was granted, date, and time on the permission form (i.e. “John Doe, Verbal permission by phone, 1-Apr-08/1300”).

3.1.5 Obtain the mailing address for the owner and, if applicable, any tenant.

3.1.6 Obtain as much information as possible about the well, including:

- The last name of the original well owner
- Year the well was drilled
- Well depth (drilled and standing water)
- Depth to the first perforations in the well casing
- Previous well sample results
- The proximity of other wells (if any) on the property

3.2 Examine the Well and Determine Location of a Sample Port

3.2.1 Determine if the well is suitable for sampling based on the criteria listed in SOP FSWA006.01. Continue with the sampling procedures if the well meets those criteria. The type of well may determine the availability of a suitable sample port (Figure 1).

3.2.2 If conditions are found that render the well unsuitable for sampling, terminate the sample collection and inform the owner that you will not be able to sample their well.

Figure 1. Typical well pump types: (A) submersible, (B) turbine, (C) jet.

A) Submersible. The entire pump is down the well casing. Typical sample port will be a snifter valve.

B) Turbine. Varies in size from small domestic pumps to huge irrigation and municipal wells. The motor is above ground and it drives the pump below by means of a long shaft.

C) Jet. These pumps may also be positioned vertically over the well casing, appearing similar to a small turbine pump. They are only useable when the depth to water is less than 70 feet. These wells often do not have a sample port before the tank because allowing air into the line may break the vacuum needed for the pump to function. With a fixed bladder tank, (pictured) the sample may be taken from any faucet.

3.3 Sampling Procedure

Every effort should be made to maintain a clean transport and sampling environment to prevent contamination of the sample. All equipment and containers referred to in this procedure should be clean prior to use and stored in a clean environment. Sample containers, polystyrene foam bottle holders, alligator valves, snifter valves and snifter tubes should be transported in plastic bags. The sampling vehicle interior or truck bed must be clean prior to loading equipment and care taken to keep it clean during sampling. All equipment and sample containers are taken directly from the vehicle to plastic ground cloths and never allowed to touch anything at the sampling site. Gloves must be worn when handling open sample bottles and snifter tubes. Change gloves whenever there is a possibility of them becoming contaminated with anything other than the sample being collected. For example, change gloves between switching from sample collection to filling field blanks or after moving hoses. After sampling, reusable items such as garden hoses, snifter tubes and alligator valves should be placed in separate plastic bags for later cleaning. Ground covers, used gloves and other items should be placed in bags to prevent contamination of the vehicle and will be disposed of offsite. Any equipment that may have been contaminated during sampling should be washed off, using DI water for a final rinse, prior to being placed in the vehicle. Any items that may have had direct contact with pesticide materials or application equipment will be quarantined in plastic bags for decontamination or disposal.

3.3.1 Determine the type of sample port you will be using. Sample port types include snifter (Schrader®) valves (Figure 2), discharge pipes, faucets, or petcocks. Examine the system carefully to understand the direction of flow to determine which potential sample ports are before the tank (Figure 3) and before any water treatment, such as chlorination or water softening.

Figure 2. A snifter (Schrader®) valve sampling port (red arrow) and an electrical points box (blue arrow) installed on a backflow valve.

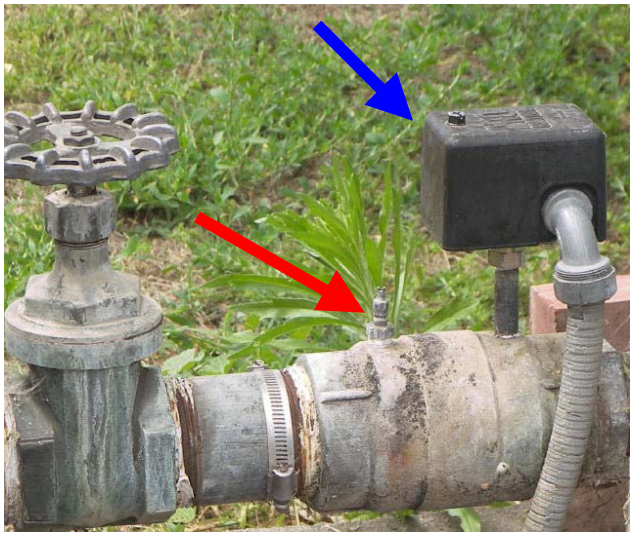

Figure 3. Tracing what ports are before or after the tank is not always easy. In this case, a faucet outside the shed wall to the right could be used as the sample port if the proper valves were opened, negating the need to collect samples through the snifter valve.

3.3.2 Determine storage tank type. The combination of the storage tank type and sample port chosen will determine the sampling procedure to follow. For reasons discussed in SOP FSWA006.01, water should be sampled prior to, but not after

the storage tank. Thus, it is desirable to have the sample port located before the water enters the storage tank. Some well systems, particularly wells with jet pumps or unpressurized storage tanks, rarely have sample ports before the tank (Figure 1C).

3.3.2.1 Pressure Tank-If the well has a pressure tank (Figure 4), you may be required to sample from a snifter valve sample port located before the sampling tank. If the sample port is a snifter valve, refer to procedure 3.4 for purging and 3.5 for sampling.

Figure 4. Pressure tank well. This type of tank will have one pipe for the water flowing into the tank and another for discharge from the tank. The faucet on the right is being used to keep the pump running. The faucet on the left is the best sample port.

3.3.2.2 Fixed Bladder Tank-If the well has a fixed bladder tank (Figure 5), water may be sampled from any nearby faucet while the well is running. Purge according to 3.4.2. If the well has a faucet or petcock sample port, refer to procedure 3.6.

Figure 5. Diagram and picture of a fixed bladder tank well. Note that there is only one pipe connected to the tank itself. Samples can be collected from the faucet on the left after the hose has been removed.

3.3.2.3 Unpressurized Tank - If you are sampling from a well with an unpressurized storage tank or stand pipe, you will need to sample the well water before it enters the storage tank. As there is typically no valve located on the pipe which deposits well water into the storage tank, you will need to place your collection container under the flow of water coming from the pipe to catch the water before it enters the tank (Figures 6 and 7).

Figure 6. Unpressurized storage tank. Samples were collected from the inflow into the tank from the small pipe going up the side and entering at the top by reaching inside the tank through the access port.

Figure 7. Sampling from a well discharge pipe into a standpipe. Extreme care is required to prevent dropping a bottle while sampling. The force of the water exiting the discharge pipe can be very high.

3.4 Purging Procedure

Purging is required prior to collecting any samples. Purging time is based on the minutes the pump runs. If the pump cycles on and off during the purging process be sure to keep track of the total time the pump is running. If the well is already running when the crew arrives at the well, the time the well has been running may be applied to the required purging time. To speed up the process of purging make sure the well tank is emptying as fast as the pump can fill it. Do this by opening enough faucets around the house and monitoring the pressure gauge on the storage tank. If the output is equal to the inflow, the gauge will hold at a steady level below the pump's shutoff pressure.

3.4.1 For **sampling ports prior to the tank** purge the well casing by opening enough faucets to force the well pump to run for a minimum of 10 minutes.

3.4.2 **Sampling after the tank** requires draining three tank volumes prior to sampling. Purging time must be calculated based on tank volume and outflow rate. Check to make sure the owner will permit such water use before flushing the tank. For larger storage tanks, it is preferable to locate a different well in the area or arrange to return at a later date when the well is scheduled to run for an extended period. If the well has already been running long enough to have drained the three tank volumes (i.e., running an irrigation system for several hours), it is possible to collect the sample after the tank without purging. Always note that the sample was obtained after the tank on the Well Information form.

3.5 Preparing a Snifter Valve Sample Port for Sample Collection

3.5.1 After the purging cycle, turn faucets off and turn off the power at the circuit box or switch box. A final method to shut off a well is by interrupting the points in the point's box. Staff should not attempt this procedure until an experienced staff member has trained them.

3.5.2 Before removing or replacing the snifter valve, cover the electrical point box (Figure 2) with a plastic bag and secure with duct tape to avoid getting water in the points and short-circuiting the system (Figure 9).

3.5.3 Unless the existing snifter valve (Figure 9) is fairly free of corrosion or deposits, it is advisable to replace the entire snifter valve to prevent leakage if the valve core will not reseat after sampling. When replacing the snifter valve, use the Teflon® tape to wrap the threads to prevent leaking, and take care not to strip the threads.

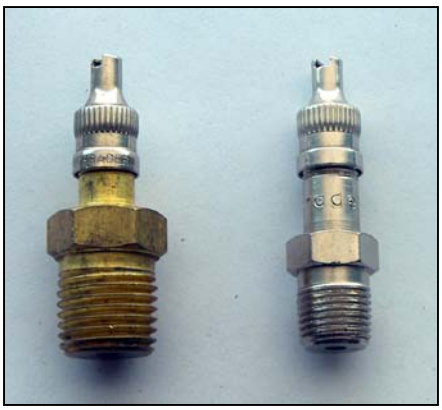

Figure 9. ¼ inch and ⅛ inch (also called brass and silver) snifter valves. The ¼ inch snifter valve may also have a chrome finish. Caps may be used to tighten or remove the valve cores. Use a 7/16 inch wrench on the ¼ inch valve and a 5/16 inch wrench on the 1/8 inch valve.

3.5.4 Obtain a clean alligator valve cap (Figure 10). Push down on the spring loaded valve core plunger with a pen point, using a slight sideways motion, until the bottom of the plunger locks on the rim above the threads on the inside bottom of the cap. Carefully screw the alligator cap down onto the snifter valve insuring that the plunger remains locked down to depress the snifter valve core. If the plunger pops up, press it down again with a pen point until it locks before screwing it on to the snifter valve.

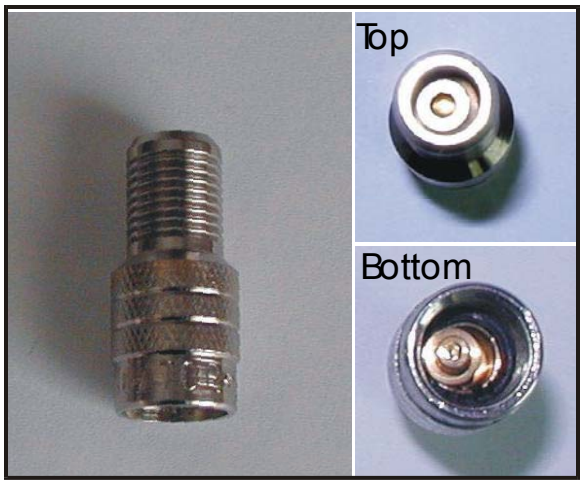

Figure 10. Alligator valve cap. The top and bottom views show the core “cocked”.

3.5.5 Attach a snifter sampling tube (figure 11). (This is a Tygon® connector/Teflon® tube attachment that is slipped over the alligator cap.)

3.5.6 Resume power to pump and open some faucets.

3.5.7 Let water flow through sampling tube for 20 seconds to flush out the tube as a native rinse.

Figure 11. Snifter sampling tube attached alligator valve cap that has been screwed onto a snifter valve. The tube is being flushed prior to collecting the sample.

3.6 Preparing a Faucet or Petcock Sample Port for Collection

3.6.1 Before collecting a sample, check the faucet/sample port for any debris.

3.6.2 Open the faucet completely, and let the water run for approximately one minute to flush out any remaining debris inside the faucet/sample port before collecting your sample.

3.7 Collection of a Field Blank

3.7.1 While purging the well, collect a field blank sample following the instructions provided in SOP QAQC011.00.

3.8 Sample Collection

After completing the purging procedure, finding and setting up the sampling port as in sections 3.5 or 3.6 and collecting the field blank, it is time to collect the ground water samples. Gloves must be worn during sample collection.

3.8.1 Conduct a native rinse by rinsing out sample containers (only the containers that are not pre-packaged with a preservative) with well water before collecting the well sample.

3.8.2 Completely fill the appropriate number of bottles with well water to eliminate any airspace under the cap unless the bottle is pre-acidified. In cases where the flow cannot be sufficiently restricted, or is angled so that completely filling the bottle is impossible, it may be necessary to use the cap or a separate clean fill bottle to add the last few drops to completely fill the bottle. A small air bubble is not a problem if the analytes are non-volatile.

3.8.3 If no sample preservation is required, rinse a one-half pint jar with the well water and then fill the jar with well water for a pH measurement. Determine pH (SOP EQWA002.00). Record the data on the Chain of Custody form and the Well Information Form.

3.8.4 If pH adjustment is required using HCl for sample preservation, see section 4.4.

3.8.5 Turn off faucets and power to pump if using a snifter valve sample port (see section 3.9).

3.8.6 Remove gloves.

3.9 After Sample Collection

3.9.1 After completing sample collection, close all faucets and turn the power to the circuit box or switch box to the off position.

3.9.2 Detach the snifter sampling tube.

3.9.3 Unscrew the alligator cap from the snifter valve.

3.9.4 Resume power to pump.

3.9.5 If the pump does not immediately restart, open faucets to reduce the pressure in the storage tank, until the pump turns on, then close the faucet(s) and allow the pump to run through one complete cycle to check that it is turning on and off properly and that there are no leaks from the snifter valve core. If the valve leaks turn off the system, tighten the valve core, restart the system, and check for leaks again.

3.9.6 Remove the plastic bag covering the points box.

3.9.7 Make sure all faucets turned on for sampling are turned off, any hoses used recoiled, and all sampling equipment and waste materials put back in the vehicle prior to leaving the site.

3.10 Packaging Samples

Refer to SOP QAQC005.00

3.11 Documentation

3.11.1 Prepare a chain of custody record to accompany each water sample and field blank as described in SOP ADMN006.01. At the very least, the primary COC should be completed before leaving the sampling site.

3.11.2 Prepare a Well Information Form to document the following:

3.11.2.1 The well condition by observing the well casing, cap, and pad, noting any cracks or openings.

3.11.2.2 The condition of the surrounding well location by noting any cracks in the soil, soil type, slope, and depressions. Also make a note of the presence or use of pesticides, and anything unusual.

3.11.2.3 Micro and macro sketches of well construction and location. The micro sketch should show the general

layout of the well, pad, and sample port, and significant features such as pad cracks, and casing holes. The macro sketch should include distances to mappable landmarks (roads, railroads, canals), land use surrounding the well, and the locations of nearby wells.

3.11.2.4 Take close-up and vicinity photographs. If the camera has a voice notation function, record the study number and site location. If the camera does not have a voice notation feature, the first picture taken should be a close-up of the filled-out permission form for that site. Pictures will be printed out upon returning to the office.

3.11.2.5 Record the GPS position and the depth to ground water (if possible).

3.11.3 Upon returning to the office, prepare a Well Data Sheet (DWR Form 429) to request a California Well Number for any wells not already assigned a state well number in our database. Fill out the requested information and prepare a map showing the well location with respect to the nearest intersection. Plot the well location on a U.S. Geological Survey 7 ½ minute topographical quadrangle map (1:24000 scale map with computer mapping software) and attach it to the DWR Form 429. Make copies of this paperwork and give it to the Well Inventory Database Manager. The well number request will be mailed to the DWR district office in which the well is located.

4.0 STUDY-SPECIFIC DECISIONS

4.1 Number of Wells to Sample

The total number of wells to sample in an area will be included in the study protocol. The number of wells that can be sampled on a single trip will be based on several factors that include: the number of days the crew will devote to sampling, the size of the area to be covered, the anticipated availability of wells in the area, the number of sample bottles collected from each well site and the number of ice chests that can fit into the vehicle.

4.2 Number of Samples to Collect

This depends on the analyte that is under evaluation and the type of study that is being performed. Refer to the well monitoring study protocol to determine the number of samples that are required to be collected for each analyte per well in the study. A minimum of two replicate samples (one primary and one back-up sample) and a field blank sample should be collected for each set of analyses per well site.

4.3 Sample Containers

Refer to the study protocol. If there is no protocol, or the protocol is not specific, the project leader must confer with the Quality Assurance (QA) Officer to determine the appropriate container and storage method to be used.

4.4 Sample Preservation

4.4.1 Refer to the study protocol for instructions on proper sample preservation. If there is no protocol, or the protocol does not adequately explain how to preserve the samples, ask the QA Officer what type of preservation materials are required for the study (i.e., acidification, ice type).

4.4.2 Acidification: SOP FSWA007.00 contains instructions for preserving samples by acidification using hydrochloric acid.

4.4.3 Ice materials: Options include, but are not limited to, bags of ice, dry ice, or blue ice. This choice depends upon the type of sample container that was selected, the volume of water in the container, the temperature at which the sample needs to be stored during transportation to the laboratory, and the method of transportation (ground or air freight).

5.0 REPAIRING A BROKEN WELL

If you break a well during the sampling process, it is DPR's responsibility to assure that the well is fully repaired by a licensed vendor. If this happens:

5.1.1 Contact a licensed vendor and arrange for the repairs. Let the vendor know the state will be paying for the repair.

5.1.2 Contact your supervisor or an EM Branch Manager (EPMI or Branch Chief) to explain the problem.

5.1.3 The supervisor/manager will contact the Business Services Office (BSO) to obtain payment authorization and the "Cal-Card" credit card information. (If no supervisors or managers are available, contact BSO directly.)

5.1.4 Pay the repair bill and provide the invoice to the EM Branch administrative assistant for processing on return to the office.

6.0 APPENDIX: FORMS

APPENDIX 1: Department of Pesticide Regulation Permission Form for Request to Sample on a Property

APPENDIX 2: Department of Pesticide Regulation Well Information Form

APPENDIX 3: Department of Water Resources Well Data Form 429 (instructional version)

APPENDIX 4: Department of Water Resources Well Data Form 429 (blank sheet)

APPENDIX 5: Department of Pesticide Regulation Chain of Custody Form Record